

## **Tropical Freshwater Fish Fauna of Central Thailand**

**Jun Kil Choi\*, Jae Seok Choi<sup>1</sup> and F. William Beamish<sup>2</sup>**

(Department of Biological Science, Sangji University, Wonju 220-702, Korea;

<sup>1</sup>Department of Biology, Kangwon National University, Chuncheon 200-701, Korea;

<sup>2</sup>Department of Biology, Burapha University, Bangsaen, Chonburi 201-31, Thailand)

### **ABSTRACT**

The fish described in this paper were sampled from four watersheds in the Eastern, Chao Phraya, Peninsular, and MaeKlong regions of central Thailand, between the years 2000-2004. A total of 124 species were captured from 160 stream and river sites, using an electrofishing method. 33 of these species were captured in the Eastern region and 42 in the Peninsular region. In the Chao Phraya and MaeKlong areas, the fish species were both more abundant and more varied, and 52 and 91 species, respectively, were collected in these regions. Seven species (*Brachydanio albolineatus*, *Rasbora paviei*, *Systemus binotatus*, *Homaloptera smithi*, *Monopterus albus*, *Macrognathus circumcinctus*, *Channa gaucha*) were commonly found in all of the watersheds.

Key words: central Thailand, electrofishing, tropical freshwater fish

### **INTRODUCTION**

The area of Thailand located in the center of mainland Southeast Asia comprises 513,115 km<sup>2</sup>, and is divided into two broad geographic regions: a large section in the northern part, and a smaller peninsular section in the south. The main body of the country is bordered by Myanmar on the west, Laos on the north and east, Cambodia at the southeast, and by the Gulf of Thailand to

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\*To whom correspondence should be addressed

Tel: 82-33-730-0434, Fax: 82-33-730-0430, E-mail: jkilchoi@sangji.ac.kr

the southeast, and the Gulf of Andaman to the southwest. Thailand primarily drains into two river systems the Chao Phraya in the west, and the Mekong in the east.

The diversity of freshwater fishes in Thailand is one of the highest in the world, with over 500 species presently described (Nelson, 1994). In spite of this enormous diversity, ecological studies on stream fish with regard to distribution, abundance, assemblage, and community structure, have only been rarely conducted in these tropical regions. It is commonly believed that freshwater fish do not live in random assemblages, but rather in structured assemblages or communities held together by favorable stochastic or deterministic abiotic or biotic mechanisms (Smith and Powell, 1971; Rahel and Hubert, 1991; Jackson et al., 2001). Over large geographic regions, the assemblage structures adopted by groups of fish may also reflect additional factors, including climate and dispersal barriers, factors which are not generally evident within smaller regions or waterways. Some of the factors that are important at the regional level have not been determined to be important in individual waterways or in smaller areas. This is likely a manifestation of scale. In some cases, a small number of environmental variables appears to exert strong influence over fish assemblage structures (Harvey, 1975; Robinson and Tonn, 1989), whereas, in other fish, assemblages are associated with a broader range of factors (Edds, 1993). Biotic factors have been determined to be important, and in some systems, their strength relates to the intensity of environmental fluctuations (Grossman et al., 1998). When fluctuations are intense and unpredictable, assemblage structures appear to be determined principally by interactions occurring between a disturbance and species-specific evolutionary constraints on behavior, morphology, and physiology (Matthews, 1986; McIntosh, 1995; Grossman et al., 1998; Belinda et al., 2005). Further, tropical species exhibit significant taxonomic differences from their temperate counterparts (Welcomme, 1979). The biodiversity of freshwater fishes in tropical area is quite large relative to that seen in temperate zones (Nelson, 1994).

## MATERIALS AND METHODS

The fish referenced in this study were sampled from stream and river sites in four watersheds the Eastern, Chao Phraya, Peninsular, and MaeKlong regions, distributed throughout central Thailand, between the years 2000 and 2004 (Fig. 1). Most of the sample sites were located in the MaeKlong ( $n = 92$ ) and Chao Phraya ( $n = 50$ ) watersheds. 11 sites were sampled in the Peninsular watershed, and 7 sites in the Eastern watershed.

The fish were collected at a variety of stations, which varied in terms of stream width from 0.7 to 25.5 m, in length from 7.3 to 90.0 m, and in area from 8 to 1,620 m<sup>2</sup>. The three associated geometric means were 4.1 m, 23.4 m, and 95 m<sup>2</sup>, respectively. At all sites, once an area was selected, retaining nets of approximately 3 mm mesh were installed across the stream, thereby preventing the emigration or immigration of fish larger than this mesh size from or into the enclosed area. Prior to conducting the procedure, we assessed the conductivity of the stream water, such that the appropriate voltage and electrical wave configuration could be set, in order to maximize fishing efficiency without jeopardizing the health of the fish. Electrofish sampling was then initiated at the downstream blocking net, moving slowly towards the upstream blocking net



**Fig. 1.** Map of the watersheds of Thailand where fish samples were collected.

(Fig. 2). We made four to six passes over each of the site areas (Carle and Strub, 1978). The fish abundance was expressed in terms of density (number/100 m<sup>2</sup>) and incidence of occurrence. Species diversity was expressed as a simple count (number of species).



Fig. 2. The electrofishing Instrument and the photograph of the sampling. Prior to starting the electrofishing.

The species were identified in the field, and the total lengths of each were measured. Occasionally, we also weighed the biomass of individual fish. When we were unable to assign species status within the field, the relevant fish were preserved in 10% formalin for 10 days, and then transferred to 70% ethanol for permanent storage.

The systematics of Thai freshwater fishes are currently characterized by some equivocation. The names provided in the check list compiled by Vidthayanon, Karnasuta, and Nabhitabhata (1997) followed the classification system established by Nelson (1994). The names of a few freshwater species, however, were updated in accordance with recent taxonomic revisions. Fish were identified using a number of sources, including Kottelat (1994, 1998), Fang (1997), Musikasinthorn (1998), Fang and Kottelat (1999), and Ng and Kottelat (2000).

## RESULTS AND DISCUSSION

A total of 124 species were captured from all sites. The overall number of species was lowest in the Eastern and Peninsular watersheds, at 33 and 42, in which the number of sites was also low. The overall number of species was highest in the Chao Phraya and MaeKlong regions, at 52 and 91, in which the sites were more numerous (Table 1). The number of individuals captured per site, when adjusted to a standard area of 100 m<sup>2</sup>, varied between 2 to 1,452.

Species occurrence and abundance was high in only a few species in each of the watersheds, and only seven species were common to all of the tested watersheds. These species were identified as *Brachydanio albolineatus*, *Rasbora paviei*, *Systomus binotatus*, *Homaloptera smithi*, *Monopterus albus*, *Macrognathus circumcinctus*, and *Channa gaucha*.

*M. albus* has been identified in muddy ponds, swamps, and rice fields in Korea. This species tends to dig burrows in moist earth in the dry season, enabling it to survive without water for

**Table 1.** Four watersheds and sampling sites, which fish were collected. The names of some rivers were not found.

Watershed	Number of sites	River	Province
Eastern	1	Khao Mapring	Trat
	1	Nam Tok Khlong Kaeo	Trat
	3	Khlong Sato	Trat/Chantaburi
	1	Khlong Pong Nam Ron	Chantaburi
	1	Khlong Klang	Chantaburi
Chao Phraya	3	Kongshi	Chonburi
	2	Ban Than Trang	Chonburi
	3	Chan Ta Than	Chonburi
	3	Phan Sadet	Chonburi
	18	Surasak	Chonburi
	15	Khao Ha Yot	Chonburi
	1	Paknam	Chonburi
	1	Tributary of Bangpakong	Chonburi
	2	Prachangkham	Prachinburi
Peninsular	5	Nangrong	Chachoengsao
	1	Klong Yang Khwang	Prachuap Khirikhan
	3	Shikoo	Prachuap Khirikhan
	1	Ban Hin Pit	Prachuap Khirikhan
	2	Ban Chai Thale	Prachuap Khirikhan
Maeklong	1	Khlong Kariam	Prachuap Khirikhan
	2	Petchaburi	Petchaburi
	4	Pranburi	Petchaburi
	2	Pak Kok	Kanchanaburi
	38	Khayeng	Kanchanaburi
	15	Phacham Mai	Kanchanaburi
	6	Ban Rai	Kanchanaburi
	5	Kapok	Kanchanaburi
	2	Kratenjeng	Kanchanaburi
	5	Lichia	Kanchanaburi
	2	Kreng Kravia	Kanchanaburi
	1	Thi Khrong	Kanchanaburi
	1	Satamid	Kanchanaburi
	1	Pilok	Kanchanaburi
	1	E-pu	Kanchanaburi
	3	Tawat	Kanchanaburi
	1	Tuam	Kanchanaburi
	3	Bang Ka Loo	Kanchanaburi

extended periods. We found that fish assemblages in the tropical regions completely differed from that observed in temperate regions in Korea, with the exception of one species of *M. albus*. This might be considered a good example of how fish diversity can vary between two countries in different temperate zones.

Indeed, in the Chao Phraya and Maeklong sites, only three species occurred in more than 60% of the 50 and 91 sites, respectively (Table 2). *S. binotatus*, *R. paviei*, and *Dermogenys pusillus*

**Table 2.** Incidence of occurrence (%) / Abundance value (adjusted to a stream area of 100 m<sup>2</sup>) for each of the watersheds. The number of sites from the Eastern, Chao Phraya, Peninsular, and MaeKlong watersheds were 7, 50, 11 and 92, respectively.

No.	Nelson	Fish species	Eastern	Chao Phraya	Peninsular	MaeKlong
		Osteoglossiformes				
		Notopteridae				
1	2	<i>Chitala ornata</i>				1/<0.1
2	1	<i>Notopterus notopterus</i>			9/<0.1	5/<0.1
		Cypriniformes				
		Cyprinidae				
3	17	<i>Amblyrhynchichthys truncatus</i>				1/<0.1
4	22	<i>Brabodes gonionotus</i>		4/<0.1		2/<0.1
5	7	<i>Brachydanio albolineatus</i>	14/0.9	52/5.0	45/1.2	13/1.5
6	36	<i>Crossocheilus reticulatus</i>	29/0.7			1/0.1
7	18	<i>Cyclocheilichthys apogon</i>		2/<0.1	18/0.4	27/0.5
8	19	<i>Cyclocheilichthys armatus</i>		6/0.2		8/0.1
9	20	<i>Cyclocheilichthys heteronema</i>		4/<0.1		
10	8	<i>Danio acrostomus</i>			36/1.4	61/6
11	9	<i>Esomus metallicus</i>		8/0.2	9/0.1	
12	37	<i>Garra cambodgiensis</i>	29/0.9			
13	38	<i>Garra fuliginosa</i>	14/0.1			22/0.5
14	39	<i>Garra</i> sp.				20/0.6
15	24	<i>Hampala macrolepidota</i>	29/0.3	8/0.1		14/0.1
16	31	<i>Labiobarbus siamensis</i>				1/<0.1
17	32	<i>Labeobarbus leptocheilus</i>				3/0.1
18	33	<i>Lobocheilus quadrilineatus</i>				1/<0.1
19	123	<i>Lobocheilus rhabdora</i>				1/<0.1
20	21	<i>Mystacoleucus marginatus</i>	14/0.1	30/1.8		56/2.8
21	15	<i>Neolissochilus blanci</i>		10/0.2		
22	16	<i>Neolissochilus stracheyi</i>	57/4.4		18/1.1	23/0.6
23	119	<i>Neolissochilus soroides</i>				3/0.1
24	23	<i>Onychostoma mendionale</i>				4/0.1
25	114	<i>Onychostoma gerlachi</i>			9/<0.1	
26	4	<i>Barilius koratensis</i>				11/0.2
27	5	<i>Barilius pulchellus</i>				1/<0.1
28	34	<i>Osteochilus hasselti</i>		14/0.3	27/0.8	51/2.4
29	35	<i>Osteochilus lini</i>		4/0.1		
30	122	<i>Osteochilus waandersii</i>				4/<0.1
31	6	<i>Parachelia maculicauda</i>		2/<0.1		
32	3	<i>Paralauca riveroi</i>				1/<0.1
33	115	<i>Poropuntius deauratus</i>	100/25.4	6/0.2		4/0.9
34	25	<i>Puntius brevis</i>				7/0.1
35	26	<i>Puntius masyai</i>				2/<0.1
36	10	<i>Rasbora borapetensis</i>	14/0.7	10/0.1		2/<0.1
37	11	<i>Rasbora caudimaculata</i>				58/2.4
38	12	<i>Rasbora myersi</i>		2/<0.1		
39	13	<i>Rasbora paviei</i>	43/1.8	74/7.8	82/8.1	3/0.1
40	14	<i>Rasbora trilineata</i>		2/<0.1	9/0.1	
41	27	<i>Systemus binotatus</i>	57/2.7	84/10.4	82/7.4	63/3.6
42	28	<i>Systemus lateristriga</i>			18/0.1	
43	29	<i>Systemus orphoides</i>		26/0.6	9/0.3	14/0.4
44	30	<i>Systemus partipentozona</i>		14/0.2		
45	117	<i>Systemus stolitezkae</i>				17/1.2
46	121	<i>Systemus</i> sp.				1/<0.1
		Balitoridae				

**Table 2.** To be continued.

No.	Nelson	Fish species	Eastern	Chao Phraya	Peninsular	Maeklong
47	40	<i>Acanthocobitis botia</i>				10/0.1
48	41	<i>Acanthocobitis zonalternans</i>			27/0.7	49/1.6
49	42	<i>Balitora</i> sp.				28/1.7
50	43	<i>Homaloptera orthogoniata</i>	29/2.1			1/<0.1
51	44	<i>Homaloptera smithi</i>	100/17.7	6/0.1	46/1.2	51/1.5
52	112	<i>Homaloptera</i> sp.	14/0.8			
53	45	<i>Nemacheilus binotatus</i>				1/<0.1
54	46	<i>Nemacheilus masyae</i>		10/0.1		17/0.2
55	47	<i>Nemacheilus platiceps</i>		6/0.1		
56	48	<i>Schistura desmotes</i>				38/1.7
57	49	<i>Schistura kohchangensis</i>	43/1.9	8/0.1		
58	50	<i>Schistura vinciguerrae</i>			36/1.2	20/0.4
59	51	<i>Schistura</i> sp. 1			27/0.8	46/2.1
60	52	<i>Schistura</i> sp. 2				2/<0.1
61	53	<i>Schistura</i> sp. 3				4/0.1
62	113	<i>Schistura</i> sp. 4	29/0.9			
63	54	<i>Tuberoschistura baenzigeri</i>				8/0.1
		Cobitidae				
64	55	<i>Acanthopsis</i> sp.		4/<0.1		3/0.2
65	56	<i>Botia beauforti</i>	14/0.2			3/<0.1
66	57	<i>Botia eos</i>	14/0.3			
67	58	<i>Botia morleti</i>	14/0.1			4/<0.1
68	59	<i>Lepidocephalichthys berdmorei</i>			18/0.4	40/1.2
69	60	<i>Lepidocephalichthys hasselti</i>		40/1.0		
70	61	<i>Pangio anguillaris</i>				7/0.1
71	125	<i>Pangio fusca</i>				1/<0.1
72	62	<i>Pangio kuhli</i>		2/0.1		
		Gyrinocheilidae				
73	63	<i>Gyrinocheilus aymonieri</i>	14/0.3			
		Siluriformes				
		Bagridae				
74	64	<i>Leiocassis siamensis</i>	71/1.4	16/0.3		29/0.5
75	65	<i>Mystus gulio</i>				1/<0.1
76	66	<i>Mystus haumolleri</i>				47/0.8
77	67	<i>Mystus micracanthus</i>			9/<0.1	1/<0.1
78	68	<i>Mystus mysticetus</i>		4/0.1		
79	118	<i>Mystus singaringan</i>				3/<0.1
80	69	<i>Hemibagrus nemurus</i>	43/0.5	16/0.2		17/0.2
		Siluridae				
81	70	<i>Ompok bimaculatus</i>		22/0.3		9/0.1
82	124	<i>Silago maculata</i>			9/0.1	
83	71	<i>Parasilurus cochinchinensis</i>		2/<0.1	9/0.1	15/0.8
		Amblycipitidae				
84	72	<i>Amblyiceps macronatum</i>				41/0.8
85	73	<i>Amblyiceps mangois</i>	86/2.1	32/0.4	27/0.3	
		Sisoridae				
86	74	<i>Glyptothorax laoensis</i>				3/<0.1
87	75	<i>Glyptothorax major</i>	29/0.8			
88	76	<i>Glyptothorax platypgonoides</i>	86/6.3			1/0.1
89	120	<i>Glyptothorax</i> sp.			8/0.1	
		Clariidae				
90	77	<i>Clarias batrachus</i>		8/0.1	18/0.1	1/<0.1

Table 2. To be continued.

No.	Nelson	Fish species	Eastern	Chao Phraya	Peninsular	Maeklong
Mugiliiformes						
Mugilidae						
91	109	<i>Moolgarda seheli</i>			27/0.9	1/<0.1
Beloniformes						
Hemiramphidae						
92	78	<i>Dermogenys pusillus</i>		66/3.6	45/1.8	1/<0.1
Belonidae						
93	79	<i>Xenentodon cancilla</i>	57/1.1	10/0.1		41/0.4
Gasterosteiformes						
Syngnathidae						
94	80	<i>Doryichthys boaja</i>		2/<0.1		
95	81	<i>Doryichthys deokhatoides</i>			9/0.2	
96	82	<i>Doryichthys martensii</i>			18/0.4	
Synbranchiformes						
Synbranchidae						
97	83	<i>Monopterus albus</i>	29/0.1	22/0.8	18/0.2	21/0.3
Mastacembelidae						
98	84	<i>Macrogathus circumcinctus</i>	86/3.7	22/0.3	18/0.2	2/<0.1
99	85	<i>Macrogathus</i> sp.				2/<0.1
100	86	<i>Mastacembelus armatus</i>	86/4.5	8/0.2		53/0.9
Perciformes						
Ambassidae						
101	87	<i>Ambassis gymnocephalus</i>			27/0.9	1/<0.1
102	88	<i>Parambassis siamensis</i>		14/0.8		7/<0.1
Lutjanidae						
103	108	<i>Lutjanus argentimaculatus</i>			18/0.6	1/<0.1
Gerreidae						
104	107	<i>Gerres filamentosus</i>			36/0.4	1/<0.1
Nandidae						
105	91	<i>Badis badis</i>				10/0.1
106	89	<i>Nandus nebulosus</i>	14/0.4	8/0.1		
107	90	<i>Pristolepis fasciatus</i>		2/<0.1		27/0.4
Teraponidae						
108	111	<i>Terapon jarbua</i>			18/0.4	1/<0.1
Cichlidae						
109	106	<i>Oreochromis mossambicus</i>		2/0.1	9/0.1	1/<0.1
Eleotrididae						
110	94	<i>Butis butis</i>		14/1.4	18/0.9	44/1.6
111	92	<i>Oxyeleotris marmorata</i>		4/<0.1	9/<0.1	7/<0.1
Gobiidae						
112	93	<i>Glossogobius aureus</i>			27/0.5	1/<0.1
113	95	<i>Ghinogobius</i> sp.		30/0.1		
Scatophagidae						
114	110	<i>Scatophagus argus</i>				9/0.2
Belontiidae						
115	97	<i>Betta splendens</i>	14/0.1			
116	98	<i>Trichogaster tricopterus</i>		18/0.4		8/0.1
117	99	<i>Trichopsis vittatus</i>		22/0.6	9/0.1	
Channidae						
118	100	<i>Channa gaucha</i>	71/1.8	42/5.4	64/1.8	69/3.2
119	101	<i>Channa Lucius</i>		8/0.4		



**Table 2.** To be continued.

No.	Nelson	Fish species	Eastern	Chao Phraya	Peninsular	Maeklong
120	102	<i>Channa micropeltes</i>				1/<0.1
121	103	<i>Channa striata</i>		22/0.1	36/0.4	11/0.1
		Tetraodontiformes				
		Tetraodontidae				
122	116	<i>Diodon liturosus</i>			9/0.1	
123	104	<i>Tetraodon cambodgensis</i>				1/<0.1
124	105	<i>Tetraodon suvatti</i>	29/0.3			5/<0.1
Number of family			14	19	24	25
Number of species			33	42	52	91
Geometric mean abundance (fish/100 m <sup>2</sup> )			182	134	99	128
A total of 124 species in 28 families						

were found with the greatest frequency in the Chao Phraya region, whereas *S. binotatus*, *Kanio acrostomus*, and *C. gaucha* were found abundantly in the Maeklong regions. In the Peninsular sites, only two species, *S. binotatus* and *R. paviei*, were found in over 80% of the 11 sites. In the Eastern watershed, six species occurred with a high frequency. Fish abundance was highest in the Eastern watershed, in which a geometric mean of 182 individual fish/100 m<sup>2</sup> was recorded. Fish abundance was lowest in the Peninsular sites, at 99 individual fish/100 m<sup>2</sup>. The mean values for fish abundance in the Chao Phraya and Maeklong regions were fairly similar, at 134 and 128 individual fish/100 m<sup>2</sup>. The number of species tended to be lower in the Chao Phraya than in the other watersheds, with a geometric mean of 8.3 species/site as compared with 9.3, 11.8, and 13.4 species/site in the Peninsular, Maeklong, and Eastern watersheds.

Accordingly, most species were found with a rather low abundance across all sites within each of the watersheds. The mean abundance was <1 individual fish/100 m<sup>2</sup> for approximately 80% of the total fish species captured in the Chao Phraya, Peninsular, and Maeklong watersheds, and approximately 60% in the Eastern watershed. In other words, few species were found abundantly. In the Chao Phraya watershed, the most abundant species were *S. binotatus*, *R. paviei*, and *C. gaucha* with recorded geometric means of 10.4, 7.8 and 5.4 individual fish/100 m<sup>2</sup>, respectively. In the Maeklong watershed, the most abundant species were *D. acrostomus*, at 6.0, and *S. binotatus*, *C. gaucha*, and *Rasbora caudimaculata*, all of which were found with a total abundance of between 2.4 and 3.6 individual fish/100 m<sup>2</sup>. In the Peninsular watershed, *R. paviei* and *S. binotatus* were the most abundant species, whereas in the Eastern watershed, *P. deauratus* and *H. smithi* were found with the highest abundance, with geometric means of 25.4 and 17.7 individual fish/100 m<sup>2</sup>, respectively.

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## 태국 중부지역의 열대 담수어류상

최 준 길\* · 최 재 석<sup>1</sup> · F. William Beamish<sup>2</sup>(상지대학교 생명과학과; <sup>1</sup>강원대학교 생물학과;<sup>2</sup>Department of Biology Burapha University)

## 요 약

2000년부터 2004년까지 태국 (Thailand) 중부지역의 4개 수역인 Eastern, Chao Phraya, Peninsular, Maeklong 수계를 흐르는 하천에서 어류상 조사를 실시하였다. 160개 조사지점에 대하여 어류상조사를 실시한 결과 총 28과 124종이 확인되었다. Eastern과 Peninsular수역에서 각각 33종, 42종이 출현하였고 Chao Phraya와 Maeklong수역에서 52종과 91종이 확인되었다. 4개 수역에서 모두 출현한 종은 *Brachydanio albolineatus*, *Rasbora paviei*, *Systomus binotatus*, *Homaloptera smithi*, *Monopterus albus*, *Macrognathus circumcinctus*, *Channa gaucha* 등 7종이었다.